

2000 Warmwater Fish Survey of Tanwax Lake, Pierce County

by

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Abstract

Tanwax Lake was surveyed by a three-person crew from May 15-21, 2000. Multiple gear types (electrofishing, gill nets, and trap nets) were utilized to reduce any sampling bias associated with each sampling method. A total of 1,387 fish, representing eight species and the family Cottidae (i.e., sculpins), were sampled from Tanwax Lake. Of those, yellow perch (*Perca flavescens*), rainbow trout (*Oncorhynchus mykiss*), and largemouth bass (*Micropterus salmoides*) are the most abundant, numerically, at 77.4%, 7.4% and 6.7%, respectively. Together, these three species accounted for 95% of the total biomass of the sample. Other species sampled during the survey include: black crappie (*Pomoxis nigromaculatis*); brown bullhead (*Ameiurus nebulosus*); bluegill (*Lepomis macrochirus*); cutthroat trout (*Oncorhynchus clarki*); sculpin (family Cottidae); and pumpkinseed (*Lepomis gibbosus*). Stock density indices indicate a balanced predator-prey community, though sample sizes for most panfish species were low. Yellow perch, largemouth bass and black crappie will provide the most opportunity for the warmwater angling public. Recommendations for Tanwax Lake include: 1.) An angler creel survey to estimate angler preference, effort, and harvest; and 2.) Continued fish community surveys during both spring and fall seasons.

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Introduction and Background

Tanwax Lake is a small lake, approximately 170 acres in area, with a maximum depth of approximately 9 m (30 ft). Tanwax Lake is fed and drained by Tanwax Creek, eventually draining into the Puyallup River. The lake has a resort at either end and is surrounded by houses. There has been an Agency owned access area at the south end since 1948.

Tanwax Lake has been managed as a mixed species lake since the early 1930's, with more management emphasis on trout. Largemouth bass were first stocked into Tanwax Lake by the Washington Department of Game in August, 1936. A total of 1,700 largemouth bass, 50-75mm (2-3 inch) in length were taken from the Columbia River sloughs near Vancouver, WA, and transferred to Tanwax Lake. Two years later, in October, 1939, 300 bass at 75-100mm (3-4 in) were planted. Those were the only two recorded introductions of warmwater fish into Tanwax Lake by a State agency. Since that time, rainbow trout have been stocked yearly to support a put-and-take fishery. Currently, 15,000 rainbow trout fingerlings are raised in a net pen at the lake, and released prior to opening day. Records show that the lake was rehabilitated with rotenone on September 29, 1954.

In order to generate greater interest in fishing, many lakes, including Tanwax Lake, were once again put on an opening day schedule. The lake is now closed to all fishing between October 31st and the last Saturday in April.

Materials and Methods

Data Collection

Tanwax Lake was surveyed by a three-person team during May 15-21, 2000. Fish were captured using three sampling techniques: electrofishing, gill netting, and fyke netting. The electrofishing unit consisted of a Smith-Root SR-16s electrofishing boat, with a 5.0GPP pulsator unit. The boat was fished using a pulsed DC current of 60 Hz at 4-6 amps power. Experimental gill nets, 45.7 meters (m) long x 2.4 m deep, were constructed of four sinking panels (two each at 7.6 m and 15.2 m long) of variable-size (1.3, 1.9, 2.5, and 5.1 cm stretch) monofilament mesh. Fyke (modified hoop) nets were constructed of five 1.2 m diameter hoops with two funnels, and a 2.4 m cod end (6 mm nylon delta mesh). Attached to the mouth of the net were two 7.6 m wings, and a 30.5 m lead.

In order to reduce the gear induced bias in the data, the sampling time for each gear was standardized so that the ratio of electrofishing to gill netting to fyke netting was 1:1:1. The standardized sample is 1800 sec of electrofishing (3 sections), 2 gill net nights, and 2 fyke net nights. Sampling occurred during the evening hours to maximize the type and number of fish captured. Sampling locations were selected from a map by dividing the entire shoreline into 400 m sections, and numbering them consecutively. Nightly sampling locations were randomly chosen without replication. While electrofishing, the boat was maneuvered through the shallows at a slow rate of speed for a total of 600 seconds of “pedal-down” time or until the end of the section was reached, whichever came first. Nighttime electrofishing occurred along nearly 100% of the available shoreline. Gill nets were fished perpendicular to the shoreline; the small-mesh end was tied off to shore, and the large-mesh end was anchored off shore. Fyke nets were fished perpendicular to the shoreline as well with the lead tied off to shore, the cod-end anchored away from shore, and the wings anchored at approximately a 45E angle from the net lead. We tried to set fyke nets so that the hoops were 0.3 - 0.5 m below the water surface, this sometimes would require shortening the lead. Gill nets and fyke nets were both set overnight (roughly 12 hours per set) at two locations around the lake.

With the exception of the family Cottidae (sculpin), all fish captured were identified to the species level. Each fish was measured to the nearest millimeter (mm) and assigned to a 10 mm size class based on total length (TL). For example, a fish measuring 156 mm TL was assigned to the 150 mm size class for that species, and a fish measuring 113 mm TL was assigned to the 110 mm size class, and so on. However, if a sample included several hundred young-of-year (YOY) or small juveniles (<100 mm TL) of a given species, then a sub-sample (N ~100 fish) were measured, and the remainder were just counted. The frequency distribution of the sub-sample was then applied to the total number collected. Scales were taken from five individuals per size

class, mounted, pressed, and aged using the Fraser-Lee method. Very few scale or spine samples are taken from non-game fish for aging purposes.

Water quality data was collected during midday from the deepest part of the lake on May 15, 2000. Using a Hydrolab[®] probe and digital recorder, dissolved oxygen (mg/l), temperature (CE), pH, turbidity (NTU), and conductivity (F siemens/cm) data was gathered in the deepest section of the lake at 1 m intervals through the water column. Secchi disk readings, used to measure transparency, were taken by the methods outlined by Wetzel (1983).

Data Analysis

Species Composition

The species composition by number of fish captured, was determined using procedures outlined by Fletcher et al.(1993). Species composition by weight (kg) of fish captured, was determined using procedures adapted from Swingle (1950). Only fish estimated to be at least one year old were used to determine species composition. These were inferred from the length-frequency distributions described below, in conjunction with the results of the aging process. Young of year or small juveniles were not considered in biomass and species composition estimates because large fluctuations in their numbers may cause distorted results (Fletcher et al. 1993). Also, most of these fish would be subject to natural attrition during their first winter, resulting in a different size distribution by the following year.

Catch Per Unit of Effort

The catch per unit of effort (CPUE) of electrofishing for each species was determined by dividing the total number in all size classes equal or greater than stock size (defined in Appendix A), by the total electrofishing time (seconds). The CPUE for gill nets and fyke nets was determined similarly, except the number equal or greater than stock size was divided by the number of net-nights for each net (usually one). An average CPUE (across sample sections) with 80% confidence interval was calculated for each species and gear type.

For fishes in which there is no published stock size (i.e., sculpins, suckers, etc.), CPUE is calculated using all individuals captured. Furthermore, since it is standardized, the CPUE is useful for comparing stocks between lakes.

Length-Frequency

A length-frequency histogram was calculated for each species and gear type in the sample. Length-frequency histograms are constructed using individuals that are age one and older (determined by the aging process), and calculated as the number of individuals of a species in a given size class, divided by the total individuals of that species sampled. Plotting the histogram

this way tends to flatten out large peaks created by an abundant size class, and makes the graph a little easier to read.

Stock Density Indices

Stock density indices, used to assess the size structure of fish populations. Proportional stock density (PSD and relative stock density RSD) are calculated as proportions of various size-classes of fish in a sample. The size classes are referred to as minimum stock (S), quality (Q), preferred (P), memorable (M), and trophy (T). Lengths have been published to represent these size classes for each species, and were developed to represent a percentage of world-record lengths as listed by the International Game Fish Association (Gablehouse 1984). These lengths are presented in Appendix A.

The indices calculated here are described by Gablehouse (1984) as the traditional approach. The indices are accompanied by a 80% confidence interval (Gustafson 1988) to provide an estimate of statistical precision.

Relative Weight

A relative weight index (W_r) was used to evaluate the condition (plumpness or robustness) of fish in the lake. A W_r value of 1.0 generally indicates a fish in good condition when compared to the national average for that species and size. Furthermore, relative weights are useful for comparing the condition of different size groups within a single population to determine if all sizes are finding adequate forage or food (ODFW 1997). Following Murphy and Willis (1991), the index was calculated as $W_r = W/W_s \times 100$, where W is the weight (g) for an individual fish from the sample and W_s is the standard weight of a fish of the same total length (mm). W_s is calculated from a standard log weight - log length relationship defined for the species of interest. The parameters for the W_s equations of many fish species, including the minimum length recommendations for their application, are listed in Anderson and Neumann (1996).

Age and Growth

Age and growth of warmwater fishes were evaluated according to Fletcher et al. (1993). Total length at annulus formation, L_n , was back-calculated using the Fraser-Lee method. Intercepts for the y axis for each species were taken from Carlander (1982). Mean back-calculated lengths at each age for each species were presented in tabular form for easy comparison between year classes. Mean back-calculated lengths at each age for each species were compared to averages calculated from scale samples gathered at lakes sampled by the warmwater enhancement teams.

Results and Discussion

Water Quality and Habitat

Water quality parameters were collected in the deepest section of Tanwax Lake on May 15, 2000. Dissolved oxygen levels (Table 1) drop off below 4 meters to levels barely suitable for warmwater fish and not suitable for trout. Temperature declines steadily with increasing depth, but the lake is not stratified thermally.

Tanwax Lake lies in the Nisqually River drainage basin. The lake is fed by the outflow of Benbow Lake, and water exits through Tanwax Creek.

Table 1. Water chemistry parameters collected from Tanwax Lake, fall 2000.

Depth (m)	Temp (C)	pH	O ² mg/l	Turbidity NTU	Conductivity Fsiemens/cm
0	18.36	7.23	10.18	48.6	64.0
1	17.75	7.29	10.08	33.4	63.7
2	14.10	7.14	9.73	31.6	62.8
3	13.56	6.90	8.44	28.0	62.7
4	12.87	6.65	7.52	29.3	63.7
5	10.90	6.32	3.32	28.9	64.8
6	9.63	6.09	2.02	28.0	66.2
6.8	9.32	5.97	1.37	28.2	67.5

Species Composition and Relative Abundance

A total of nine fish species were encountered while sampling Tanwax Lake (Table 2): largemouth bass (*Micropterus salmoides*), yellow perch (*Perca flavescens*), rainbow trout (*Oncorhynchus mykiss*), black crappie (*Pomoxis nigromaculatus*), brown bullhead (*Ameiurus nebulosus*), bluegill (*Lepomis macrochirus*), cutthroat trout (*O. clarki*), sculpin (family Cottidae), and pumpkinseed (*L. gibbosus*). Of those, yellow perch and stocked rainbow trout were most abundant numerically at 77.4% and 7.4% respectively. Largemouth bass and stocked rainbow trout represented 42.5% and 39.9% of the total biomass, respectively.

Table 2. Species composition by weight (kg), and number of fish captured at Tanwax Lake (Pierce County) during May 2000.

Species	Species Composition					
	by Weight		by Number		Size Range (mm)	
	(kg)	(%w)	(#)	(%n)	Min	Max
Largemouth bass	53.58	42.51	93	6.71	66	555
Yellow perch	50.32	39.92	1074	77.43	59	345
Rainbow trout	16.07	12.75	102	7.35	160	311
Black crappie	3.82	3.03	85	6.13	50	239
Brown bullhead	0.77	0.61	3	0.22	210	305
Bluegill	0.69	0.55	13	0.94	38	166
Cutthroat trout	0.31	0.25	4	0.29	183	230
Sculpin	0.26	0.21	11	0.79	105	142
Pumpkinseed	0.22	0.18	2	0.14	155	168

Electrofishing proved to be the most effective sampling technique for all species in Tanwax Lake (Table 3), though gill nets were effective for stocked rainbow trout. While electrofishing, yellow perch and largemouth bass were encountered most frequently, with CPUE's of 197 and 23 fish per hour, respectively. Gill netting was an effective technique for yellow perch and stocked rainbow trout, catching 75 and 14 fish, respectively, per net night.

Table 3. Catch-per-unit-of-effort (# fish/hour for electrofishing and # fish/net night) for the May 2000 warmwater fish sample at Tanwax Lake, Pierce County.

Species	Electrofishing			Gill Netting			Fyke Netting		
	(#/hour)	80% CI	Sample sites	#/net night	80% CI	# net nights	#/net night	80% CI	# net nights
Yellow perch	197.31	25.91	12	75.00	6.41	2	—	—	2
Largemouth bass	22.58	4.72	12	—	—	2	—	—	2
Black crappie	19.15	6.80	12	5.50	0.64	2	1.00	1.28	2
Rainbow trout	15.37	5.46	12	14.00	1.28	2	—	—	2
Sculpin, Unknown	5.42	2.73	12	—	—	2	—	—	2
Bluegill	5.35	2.34	12	—	—	2	—	—	2
Brown bullhead	1.47	0.99	12	—	—	2	—	—	2
Pumpkinseed	1.00	1.28	12	—	—	2	—	—	2
Cutthroat	—	—	12	0.50	0.64	2	—	—	2

Stock density indices (Table 4) indicate a balanced fish community. PSD's of bass and a weighted average PSD of largemouth bass and sunfish (crappie, bluegill, pumpkinseed, yellow perch) are 67 and 21, respectively.

Table 4. Stock density indices by gear type and species, accompanied by an 80% confidence interval, for fish sampled during the May 2000 warmwater fish survey at Tanwax Lake, Pierce County.

Species	# Stock Length	Quality		Preferred		Memorable		Trophy	
		PSD	80% CI	RSD-P	80% CI	RSD-M	80% CI	RSD-T	80% CI
Electrofishing									
Black crappie	39	5	5	0	—	0	—	0	—
Bluegill	11	27	17	0	—	0	—	0	—
Brown bullhead	3	100	0	33	35	0	—	0	—
Largemouth bass	46	67	9	57	9	7	5	0	—
Pumpkinseed	2	100	0	0	—	0	—	0	—
Rainbow trout	31	0	—	0	—	0	—	0	—
Yellow perch	401	23	3	1	1	0	—	0	—
Gill Net									
Black crappie	11	0	0	0	—	0	—	0	—
Rainbow trout	28	0	0	0	—	0	—	0	—
Yellow perch	150	31	5	0	—	0	—	0	—
Fyke Net									
Black crappie	2	0	—	0	—	0	—	0	—

Summary by Species

Micropterus salmoides, largemouth bass

Largemouth bass ranged in size from 66 to 555 mm total length. The size distribution of largemouth bass (Figure 1) is fairly well defined across the size range, with a strong year class at 150-200 mm and a strong grouping of age classes at 430-510 mm. This may be an indication of variable recruitment, or high angler harvest of that year class.

The relative weights (W_r) of largemouth bass in Tanwax Lake (Figure 2) are fairly consistent across the entire size range. Largemouth bass relative weights in Tanwax Lake increase slightly with increasing length and are generally centered around 100. Relative weights around 100, in general, indicate a healthy fish population where food items are fairly abundant.

Back calculated length at age shows that largemouth bass (Table 5) are growing faster than average for a western Washington lake. Largemouth bass are reaching 12 inches (305 mm) in their third year, 15 inches (380 mm) in their fifth year and 18 inches (457 mm) in their eighth year. Again, indicating an abundance of food items.

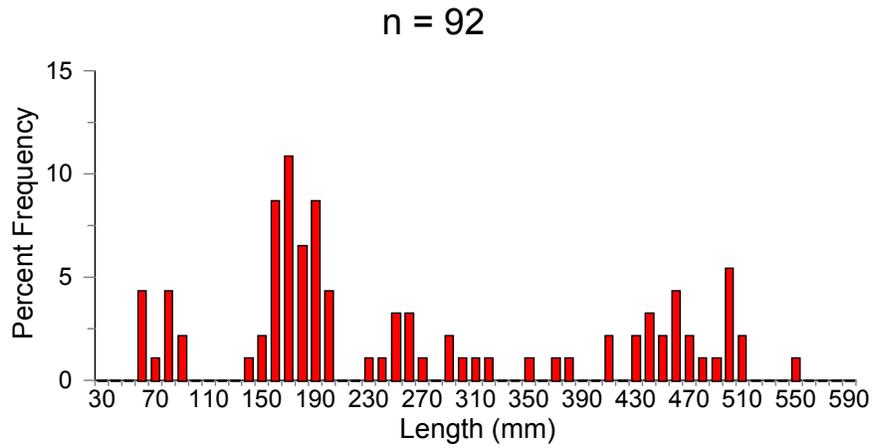


Figure 1. Length frequency distribution of largemouth bass sampled from Tanwax Lake, fall 2000.

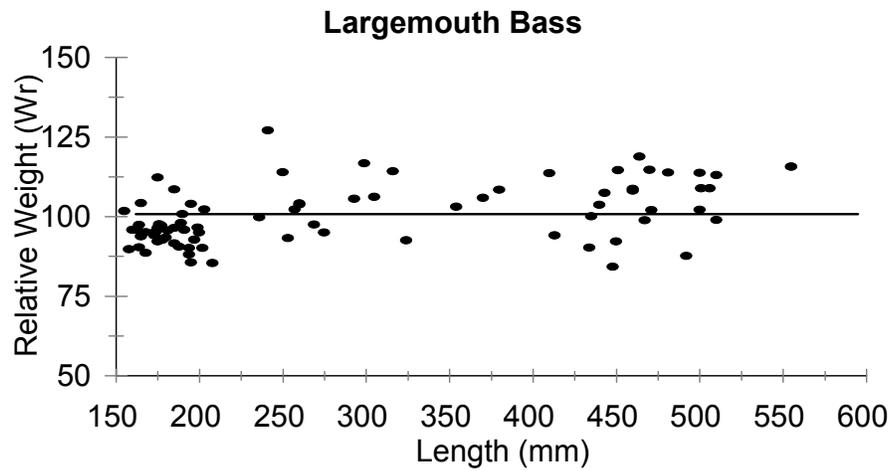


Figure 2. Relative weight distribution of largemouth bass sampled from Tanwax Lake during the fall of 2000.

Table 5. Back calculated length at age (Fraser-Lee) for largemouth bass during the fall 2000 survey of Tanwax Lake. Direct proportion and state average (also direct proportion) figures added for comparison.

Year class	n	Mean Length at Age (mm)												
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
1999	4	77												
1998	28	82	178											
1997	10	101	208	265										
1996	1	77	226	309	354									
1995	0													
1994	1	71	157	244	275	312	371							
1993	7	89	168	252	334	387	432	453						
1992	3	105	202	307	370	402	430	448	468					
1991	1	68	262	262	325	370	387	401	434	450				
1990	0													
1989	1	61	119	230	287	362	413	442	464	483	496	510		
1988	0													
1987	1	62	144	219	278	308	347	373	396	429	453	467	482	492
Avg	57	86	182	267	331	376	417	441	449	454	475	488	482	492
Direct Prop		73	177	259	326	373	415	440	448	453	474	488	481	492
State avg		60	146	222	261	289	319	368	396	440	485	472	496	

Perca flavescens, yellow perch

Yellow perch sizes ranged from 59mm to 345mm. Yellow perch sizes are fairly well defined across the lower end of its size range (Figure 3). Though yellow perch attain sizes up to 345mm, very few yellow perch above 200mm (8 inches) were represented in our sample. This is also reflected by the PSD of 23.

Relative weights of yellow perch average below 100 (Figure 4), decreasing slightly with increasing length. This is pretty typical for yellow perch populations in western Washington lakes. Low relative weights are an indicator of inefficient foraging or a lack of available prey items.

Back calculated length at age (Table 6) of yellow perch shows that, on average, yellow perch growth in Tanwax Lake is slightly above what is considered average for western Washington. Increasing our gill net saturation would help to determine if there are larger individuals in the population.

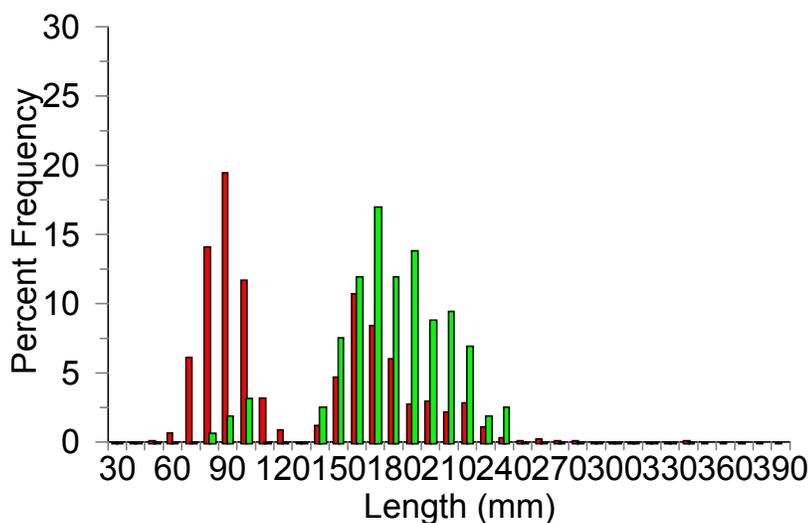


Figure 3. Length frequency distribution of yellow perch (*Perca flavescens*) sampled at Tanwax Lake, Pierce County during the May 2000 warmwater fish survey.

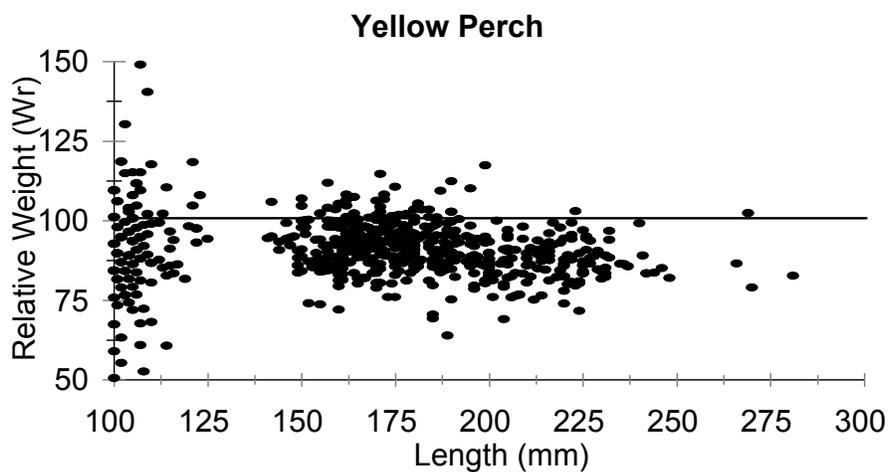


Figure 4. Relative weight distribution of yellow perch during the spring 2000 warmwater fish survey of Tanwax Lake, Pierce County.

Table 6. Back calculated length at age (Fraser-Lee method) of yellow perch sampled during the spring warmwater fish survey of Tanwax Lake, Pierce County.

Year Class	n	Mean Length at Age (mm)				
		I	II	III	IV	V
1999	31	86				
1998	32	85	165			
1997	7	97	174	214		
1996	8	85	152	197	229	
1995	12	76	136	187	216	237
Avg		85	158	197	221	237
Direct Proportion		70	152	192	219	237
State Average		60	120	152	193	206

***Onchorynchus mykiss*, rainbow trout**

Tanwax Lake is managed as a mixed species lake. Meaning, this lake receives a yearly allotment of hatchery rainbow trout to support a put-and-take trout fishery. The management intent is not to produce a self-sustaining population of trout, but to provide enough fish to support a fishery during the cooler periods of the year. On average, Tanwax Lake receives roughly 15,000 catchable hatchery fish yearly, raised and released from a net pen at the Benbow Resort. Additionally, Tanwax Lake receives a few hundred hatchery brood stock to provide a small level of “trophy” fishing.

***Pomoxis nigromaculatus*, black crappie**

Black crappie sizes ranged from 50 to 239mm total length. Smaller size classes of crappie were well defined, but fish above 200mm (8 inches) were not very abundant in our sample (Figure 5). This is also shown by our electrofishing PSD of 5. Relative weights of black crappie averaged above 100, denoting excellent condition, but decreased with increasing length. High relative weights indicate an abundant food source, and overall favorable conditions. This is also seen in the mean back calculated length at age for black crappie. Black crappie in Tanwax Lake are growing faster than average for western Washington lakes, reaching 200mm (8 inches) late in their second year (Table 7). Again, showing that conditions are favorable for crappie growth. Black crappie are either suffering from high natural mortality or angler harvest, as no fish are reaching preferred length (250mm).

Table 7. Back calculated length at age (Fraser-Lee method) of black crappie during the spring 2000 warmwater fish survey of Tanwax Lake, Pierce County.

Year Class	n	Mean Length at Age (mm)		
		I	II	III
1999	10	72		
1998	25	71	157	
1997	2	71	184	237
Avg.		72	159	237
Direct Proportion		52	157	237
State Average		46	111	157

***Ameiurus nebulosus*, brown bullhead**

Brown bullhead were not well represented in our sample. These fish are probably more abundant than our sampling indicates, but as they are bottom dwelling species, they are more difficult to see and capture while sampling. We captured three brown bullhead ranging in size from 210 - 305mm. Relative weights were 119, 108 and 91, indicating good overall condition. No spines were collected for aging purposes.

***Lepomis macrochirus*, bluegill**

Bluegill were responsible for less than 1% of our sample by number and by biomass. Like black crappie, bluegill are probably subject to either high natural mortality or angler harvest, as there were no preferred size (200mm) or larger fish, and few fish stock size or below (80mm). A PSD of 27 is reflected in the length frequency distribution (Figure 6), as there were few quality sized fish. Relative weights of bluegill show that fish are in very good condition (Figure 7).

All bluegill aged were 2+ year old fish. At age two, these fish were longer than average for western Washington lakes (Table 8).

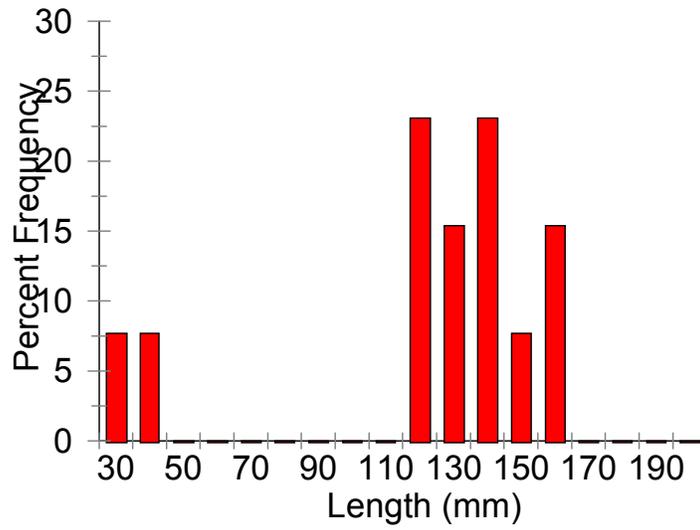


Figure 5. Length frequency distribution of bluegill from the spring 2000 warmwater fish survey of Tanwax Lake, Pierce County.

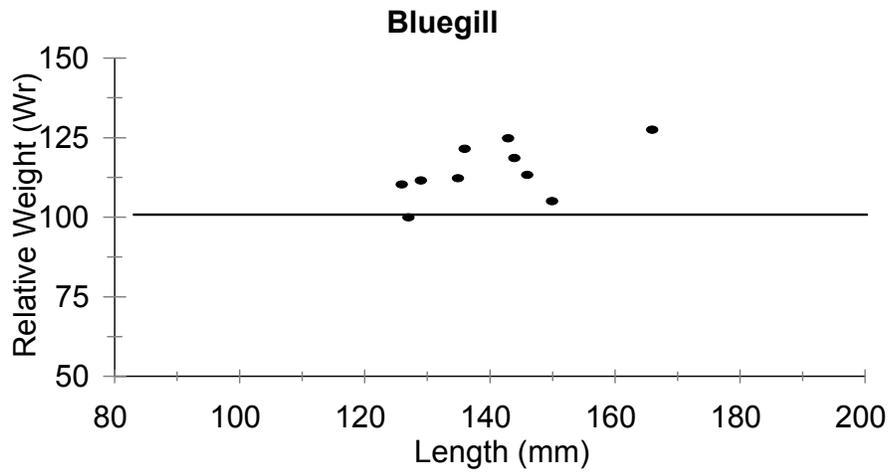


Figure 7. Relative weight distribution of bluegill during the spring 2000 warmwater fish survey of Tanwax Lake, Pierce County.

Table 8. Back calculated length at age (Fraser-Lee method) for bluegill from the spring 2000 survey of Tanwax Lake, Pierce County.

Year Class	n	Mean Length at Age (mm)	
		I	II
1999	0		
1998	11	40	125
Avg.		40	125
Direct Proportion		23	122
State Average		37	97

***Onchorynchus clarki*, cutthroat trout**

A few cutthroat trout were sampled at Tanwax Lake ranging in size from 180 - 230mm. These fish were in good overall condition, with relative weights ranging from 91 - 110. No scales were collected for aging purposes. It is possible that there is a small, self-sustaining population of cutthroat here, spawning in Tanwax Creek.

Cottidae, unidentified sculpin

Sculpin are probably more abundant in Tanwax Lake than our sampling indicates. As these fish are small bottom dwelling species, they are difficult to see and capture with our sampling techniques. Also, due to the small morphological variability between sculpin species, we do not identify these fish to the species level.

***Lepomis gibbosus*, pumpkinseed**

Only two pumpkinseed were sampled at Tanwax Lake. These fish measured 155mm (W_r , 124, age 2) and 168mm (W_r , 113, age 3). Overall condition for these two fish was very good, and growth was above average.

Discussion and Management Options

Tanwax Lake has always been managed as a mixed species lake. Stocking records show that largemouth bass were originally planted by the State Department of Game in 1933 and again in 1937. Since that time, the fishery has been maintained solely by yearly plants of hatchery rainbow trout and naturally produced warmwater fish. A slot limit regulation was placed on largemouth bass in 2000 to help protect some of the larger fish from harvest.

In 1976, an angler creel survey was completed on Tanwax Lake and two other neighboring lakes (Cummins 1977). This survey determined that during 1976, rainbow trout accounted for 75% of the harvest (10,365 trout harvested), and warmwater fish account for about 25% of the total harvest (yellow perch 14%, bass 5%, crappie 5% and sunfish 1%) for a total of 3,471 warmwater fish harvested. Also in 1976, 55% of the anglers fished for trout, while 9% fished for warmwater fish and 36% reported to fish for anything. As our management strategy on this lake has not changed much in the past 25 years, it is most likely the case that rainbow trout still account for the highest percentage of the total harvest at Tanwax Lake. Though the management strategy has not changed much over the years, angler preferences and attitudes have changed. An updated angler creel survey would help us estimate current angler effort, preferences, and harvest. These three pieces of information are essential to management, and may help us determine if sunfish are being harvested at a high rate, and will help us determine how to more effectively manage this fishery.

Beginning with the 2001 lowland lake trout fishing season, Tanwax Lake was converted back to an opening day schedule. This means that the lake is closed to all fishing from October 31, through last Saturday in April. This closing may have a limited impact on fall, winter, and spring fisheries for crappie and perch.

Relatively few sunfish were encountered while sampling. It is unclear as to whether there is high natural mortality, high angler harvest, poor spawning success, or if these species were just under represented in our sampling. The fact that the water conductivity was low (~65 F s/cm) may have led to poor electrofishing efficiency. Continued standardized surveys should be conducted on a fall/following spring basis to help us gain an idea of initial recruitment, and more directed sampling for yellow perch and black crappie will help us better determine the size structure of these populations. Continued on a rotating basis roughly every three years, we can gradually build a data set to get an idea of recruitment variability, especially for the highly variable species like black crappie.

Overall growth rates for all species in our sample were above our current averages for western Washington lakes. Furthermore, generally high relative weights for most species do not indicate that there is any bottleneck in growth (i.e. low prey availability, temperature problems, excessive

competition). An assessment of primary and secondary productivity in the lake may be beneficial to understanding the growth and abundance of certain fishes.

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Appendix A

Table A1. Length categories that have been proposed for various fish species. Measurements are for total lengths (updated from Neumann and Anderson 1996).

Species	Category									
	Stock		Quality		Preferred		Memorable		Trophy	
	(in)	(cm)	(in)	(cm)	(in)	(cm)	(in)	(cm)	(in)	(cm)
Black bullhead ^a	6	15	9	23	12	30	15	38	18	46
Black crappie	5	13	8	20	10	25	12	30	15	38
Bluegill ^a	3	8	6	15	8	20	10	25	12	30
Brook trout	5	13	8	20						
Brown bullhead ^a	5	13	8	20	11	28	14	36	17	43
Brown trout	6	15	9	23	12	30	15	38	18	46
Burbot	8	20	15	38	21	53	26	67	32	82
Channel catfish	11	28	16	41	24	61	28	71	36	91
Common carp	11	28	16	41	21	53	26	66	33	84
Cutthroat trout	8	20	14	35	18	45	24	60	30	75
Flathead catfish	11	28	16	41	24	61	28	71	36	91
Green sunfish	3	8	6	15	8	20	10	25	12	30
Largemouth bass	8	20	12	30	15	38	20	51	25	63
Pumpkinseed	3	8	6	15	8	20	10	25	12	30
Rainbow trout	10	25	16	40	20	50	26	65	31	80
Rock bass	4	10	7	18	9	23	11	28	13	33
Smallmouth bass	7	18	11	28	14	35	17	43	20	51
Walleye	10	25	15	38	20	51	25	63	30	76
Warmouth	3	8	6	15	8	20	10	25	12	30
White catfish ^a	8	20	13	33	17	43	21	53	26	66
White crappie	5	13	8	20	10	25	12	30	15	38
Yellow bullhead	4	10	7	18	9	23	11	28	14	36
Yellow perch	5	13	8	20	10	25	12	30	15	38

^a As of this writing, these new, or updated length classifications have yet to go through the peer review process, but a proposal for their use will soon be in press (Timothy J. Bister, South Dakota State University, personnel communication).

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